PRINCIPLES OF OIL EXTRACTION

Oil is extracted from a number of fruits, nuts and seeds (Table 1) for use in cooking and soapmaking¹ or as an ingredient in other foods such as baked or fried goods. Oil is a valuable product with universal demand, and the possible income from oil extraction is therefore often enough to justify the relatively high cost of setting up and running a small-scale oil milling business.

<table>
<thead>
<tr>
<th>Seeds and beans</th>
<th>Moisture content (%)</th>
<th>Oil/fat content (%)</th>
<th>Yield of oil (%)</th>
<th>Uses for by-products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>5</td>
<td>15-25</td>
<td>-</td>
<td>Animal feed</td>
</tr>
<tr>
<td>Rape</td>
<td>9</td>
<td>40-45</td>
<td>25</td>
<td>Animal feed (needs dehydrating)</td>
</tr>
<tr>
<td>Mustard</td>
<td>7</td>
<td>25-45</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sesame</td>
<td>5</td>
<td>25-50</td>
<td>45</td>
<td>-</td>
</tr>
<tr>
<td>Sunflower</td>
<td>5</td>
<td>25-50</td>
<td>20-30*</td>
<td>Animal feed, Hulls used for chicken litter, presscake for animal feed, Animal feed (needs dehydrating)</td>
</tr>
<tr>
<td>Safflower</td>
<td>5</td>
<td>30</td>
<td>-</td>
<td>-</td>
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<table>
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<tr>
<th>Nuts</th>
<th>Moisture content (%)</th>
<th>Oil/fat content (%)</th>
<th>Yield of oil (%)</th>
<th>Uses for by-products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut (fresh)</td>
<td>40-50</td>
<td>35-40</td>
<td>55-62</td>
<td>See Figure 8</td>
</tr>
<tr>
<td>Copra</td>
<td>3 - 4.5</td>
<td>64-70</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Groundnut (shelled)</td>
<td>4</td>
<td>28-55</td>
<td>40*</td>
<td>Food, snacks, soup</td>
</tr>
<tr>
<td>Palm kernel nuts (shelled)</td>
<td>-</td>
<td>-</td>
<td>45-49</td>
<td>Animal feed</td>
</tr>
<tr>
<td>Shea nut</td>
<td>34-44</td>
<td>15-45*</td>
<td>-</td>
<td>Fuel</td>
</tr>
<tr>
<td>Shea nut</td>
<td>34-44</td>
<td>15-45*</td>
<td>-</td>
<td>Fuel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Moisture content (%)</th>
<th>Oil/fat content (%)</th>
<th>Yield of oil (%)</th>
<th>Uses for by-products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil palm</td>
<td>-</td>
<td>56</td>
<td>11-20</td>
<td>Fuel, lighting</td>
</tr>
<tr>
<td>Avocado</td>
<td>69</td>
<td>11-28</td>
<td>40-44</td>
<td>-</td>
</tr>
<tr>
<td>Olive</td>
<td>50-70</td>
<td>-</td>
<td>25</td>
<td>Animal feed, fuel</td>
</tr>
</tbody>
</table>

Table 1: Sources of oil. *Traditional methods

Raw material preparation
Oilseeds and nuts should be properly dried before storage, and cleaned to remove sand, dust, leaves and other contaminants. Fruits should be harvested when fully ripe, cleaned and handled carefully to reduce bruising and splitting. All raw materials should be sorted to remove stones etc. and especially mouldy nuts, which can cause aflatoxin poisoning. When storage is necessary, this should be in weatherproof, ventilated rooms which are protected against birds, insects and rodents. Some raw materials (for example groundnuts, sunflower seeds) need dehusking (or dehulling). Small manual machines are available to give higher production rates than manual dehusking (Figure 1).

¹ See Technical Brief: ‘Soapmaking’.

Figure 1: A decorticating machine
Dehusking is important to give high yields of oil and reduce the bulk of material to be processed but in groundnut oil extraction about 10% by weight of husk should be added back to the nuts to allow oil to escape more freely from the press. Coconut is dehusked and split by skilled operators as this is faster than the available small-scale machines. Most nuts need grinding before oil extraction to increase the yield of oil. Small mills are available for grinding copra, palm kernels and groundnuts.

Some seeds (e.g. groundnuts) are conditioned by heating to 80-90°C using a seed scorcher (Figure 2), and all oil-bearing materials need to have the correct moisture content to maximise the oil yield. Other oilseeds and nuts are usually processed cold provided that their moisture content is below about 7%.

Methods of extraction
There are basically three methods of removing oil from the raw materials: solvent extraction, wet processing or dry processing. Solvent extraction is not suitable for small-scale processing because of high capital and operating costs, the risk of fire and explosions from solvents and the complexity of the process. Equipment for wet or dry processing is available at different scales of operation from household to industrial scale. Traditional methods of extraction are described below, followed by higher output manual machines and mechanised extraction.

Traditional methods
Oil is extracted from fresh coconut, olives, palm fruit shea nut etc. by separating the flesh and boiling it in water. Salt is added to break the emulsion and the oil is skimmed from the surface. In palm oil processing the fruit is first heated in a ‘digester’.

Manual methods
Oil can be extracted by pressing softer oilseeds and nuts, such as groundnuts and shea nuts, whereas harder, more fibrous materials such as copra and sunflower seed are processed using ghanis. Pulped or ground material is loaded into a manual or hydraulic press to squeeze out the oil-water emulsion. This is more efficient at removing oil than traditional hand squeezing, allowing higher production rates.

Fresh coconut meat is removed from the shell using a manual reamer (Figure 3) or a motorised reamer. The fine particles are pressed in a similar way to extract the oil emulsion. The emulsion is broken and the oil is then separated and clarified (see below).

Presses have a number of different designs, which can be grouped into screw or hydraulic operation. Both types can be manual or motor driven. In all types, a batch of raw material is placed in a heavy-duty perforated metal ‘cage’ and pressed by the movement of a heavy metal plunger. The amount of material in the cage varies from 5-30 kg with an average of 20 kg. Layer plates can be used in larger cages to reduce the thickness of the layer of raw
material and speed up removal of oil. The pressure should be increased slowly to allow time for the oil to escape. Screw types are more reliable than hydraulic types but are slower and produce less pressure. Except where a lorry jack is used (Figure 4), hydraulic types are more expensive, need more maintenance, and risk contaminating oil with poisonous hydraulic fluid.

Ghanis are widely used in Asia but less so in other areas. A heavy wooden or metal pestle is driven inside a large metal or wooden mortar (Figure 5a). The batch of raw material is ground and pressed and the oil drains out. They have relatively high capital and maintenance costs and need skilled operators to achieve high oil yields.

Motorised presses are faster than manual or animal types (Figure 5a) but are more expensive. Motorised ghanis (Figure 5b) are also available, but their higher capital and operating costs require a larger scale of production for profitability.

Expellers are continuous in operation and work by grinding and pressing the raw material as it is carried through a barrel by a helical screw (Figure 6a). The pressure inside the barrel, and hence the yield of oil, are adjusted using a ‘choke’ ring at the outlet. The equipment has higher production rates than similar sized presses but is more expensive to buy and operate.
Although manual expellers are available (Figure 6b), small scale oil millers more often use powered equipment to reduce the time and labour involved in processing. Some designs also have an electric heater fitted to the barrel to increase the rate of oil extraction. The production rate using presses and ghanis depends on the size of the equipment and the time taken to fill, press and empty each batch. The production rate of expellers depends on the size of the equipment, the speed of the screw and the setting of the choke ring.

Clarification of oil
Crude (freshly extracted) oil contains moisture, and fibre, resins, colours etc. from the plant material, which make it darker and more opaque. These materials are removed by clarification – either by letting the oil stand undisturbed for a few days and then separating the upper layer, or by using a clarifier (Figure 7). This consists of an oil drum placed above a fire. The oil is boiled to drive off water and destroy naturally occurring enzymes and contaminating bacteria. The oil is allowed to stand and contaminants separate out. The oil is filtered through a cloth and heated briefly to 100°C to boil off any remaining traces of moisture. This is usually sufficient to meet the quality needs of customers and give a shelf life of several months when correctly packaged. However, the oil requires additional refining stages of de-gumming, neutralising and de-colouring to have a similar quality to commercially refined oils, and these stages are difficult to complete at a small scale.

Packaging and storage of oil
If incorrectly stored, some types of oil rapidly go rancid and develop an unpleasant odour and flavour. The main factors that cause rancidity (in addition to moisture, bacteria and enzymes above) are light, heat, air and some types of metals. To obtain a shelf life of several months, oils should be stored in lightproof, airtight and moisture-proof containers in a cool place. Tin coated cans, glazed pottery, coloured glass and certain types of plastics are each suitable when properly sealed. Great care is needed to remove all traces of oil from re-useable containers, and to thoroughly dry them before re-filling, because any residual moisture or rancid oil on the inside will rapidly spoil fresh oil. The materials used to make processing equipment and containers should not contain copper as it promotes rancidity. Stainless steel, galvanised iron, enamelled iron and aluminium are suitable.

Use of by-products
Coconut by-products (Figure 8) have a wide variety of uses. Groundnut meal is widely used for human food (biscuits, soups etc.) when it is extracted by manual methods which do not burn the by-product. Other fruits, nuts and oilseeds produce by-products that can be used for fuel and animal feeds (Table 1). The high temperatures employed in expellers burn by-products and they are only suitable for animal feeds. However, all oil extraction businesses need to identify markets for their by-products for economic viability.
Quality assurance
The main quality checks concern raw materials, processing conditions, product quality and packaging and storage conditions. Raw materials should be checked to ensure that there is no mould growth, and that they are correctly dried, cleaned and sorted. During processing, the temperature and time of conditioning, the moisture content of the raw material, and the yield of oil should be routinely checked. Quality checks on the product include correct colour, flavour, odour, clarity and fill weight.

Oil processing as a business
The profitability of oil processing depends on reducing the capital and operating costs as much as possible, and at the same time maximising the income from the sale of oil and by-products. A careful study of all costs should be undertaken before setting up a production unit. In particular the cost of the main pieces of equipment, salaries for the expected number of workers, and the prices for raw materials, fuel and power should be assessed.

The price that can be charged for oil and by-products depends on a number of factors including quality, packaging, and the number, type and quality of competing products. These should each be assessed in order to calculate the likely income at the planned scale of production over the year. The production costs can then be compared with the expected income to calculate the likely profitability. In most cases, it is necessary to make full use of the by-products to make the enterprise financially successful.

Different systems are used for marketing and selling oils and by-products, and it is necessary to select one that meets the needs of consumers, while at the same time keeping the costs of selling as low as possible. For example, contract (or custom) oil extraction, in which farmers or households bring their crop to the oil mill for processing, has the lowest selling costs. Alternatively, oil can be sold from bulk drums into customers’ containers in markets or at the production site, or it can be packaged into retail or bulk containers and transported to towns for sale. By-products are usually sold in bulk to poultry or animal producers, or to other food or animal feed processors. It may be advantageous to locate the oil mill in an area where by-products are needed in order to reduce transport costs.

One problem that faces oil processors is to ensure that there are adequate supplies of raw material to operate at the planned production rate throughout the year. It is likely that crops will be bought during harvest time when prices are lowest, but it may be necessary to offer an incentive for farmers to supply the processing unit, rather than sell on the open market. A simple contract to buy a specified amount of crop at a fixed price can benefit both farmers and processors, provided both parties keep their side of the agreement. Oil processors also need a large working capital to buy the year’s supply of seasonal crops, and adequate storage facilities so that they remain in good condition until they are processed.
In summary, some questions to ask before setting up a small-scale oil extraction business are as follows:

- What is the local demand for oil and by-products?
- What is the existing level of competition?
- Are there enough oilseeds/nuts/fruit grown in the area for year-round work?
- Will you be able to buy it at an acceptable price, or is it already contracted to other producers?
- Will unrefined oil be acceptable to consumers?
- What price will they pay per litre of oil?
- What price can the by-products be sold for?
- What are the costs of packaging and distribution?
- Can you afford the cost of equipment without a loan?
- If a loan is needed to buy equipment and a year’s supply of crop, how long will it take for the expected income cover the loan re-payments?
- Is the projected business economically viable?

In summary, ensure that a proper feasibility study is done before investing any money in an oil processing venture.

**Equipment suppliers**

Note: This is a selective list of suppliers and does not imply endorsement by Practical Action.

**Decorticators**

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Address</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>TROPIC</td>
<td>BP 706, Douala, Cameroon</td>
<td></td>
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<tr>
<td>Zimplow Ltd</td>
<td>HIS Steelworks Road, Box 1059, Bulawayo, Zimbabwe</td>
<td></td>
</tr>
<tr>
<td>ETS A Gaubert</td>
<td>22 rue Gambetta, BP 24, 16700 Ruffec, France</td>
<td></td>
</tr>
<tr>
<td>SP Engineering Corporation</td>
<td>PB No 218, Kanpur 208 001, India</td>
<td></td>
</tr>
<tr>
<td>TAMSA Trading</td>
<td>152 Sidwell Avenue, P.O. Box 14305, 6061 Port Elisabeth, South Africa</td>
<td>Tel: 27 41 43 339/Fax: 27 41 411 731</td>
</tr>
<tr>
<td>Cooperative des Ouvriers Metallurgiques de Faranah (COMFAR) Quartier Aviation en face de l'Aeroport de Faranah, B.P. 11 Faranah / B.P. 2399 Conarky Faranah, Guinea</td>
<td>Tel: 224 41 20 88 / 41 20 98, Fax: 224 41 20 88</td>
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<tr>
<td>Ubungo Farm Implements</td>
<td>Box 20126, Dar-es-Salaam, Tanzania</td>
<td></td>
</tr>
<tr>
<td>Sismar</td>
<td>BP 3214, 20 rue Dr. Theze, Dakar, Senegal</td>
<td></td>
</tr>
<tr>
<td>Modern Engineering Company</td>
<td>1A Anna Street, Velandi Palayam, Coimbatore 641 025, Tamil Nadu, India</td>
<td></td>
</tr>
<tr>
<td>Gack Engineering</td>
<td>Tantra Hills, New Achimota, Ant / B / 016 Accra, P.O. Box 15883 Accra, Ghana</td>
<td>Tel: (221) 21 404109/403744/403801</td>
</tr>
<tr>
<td>Farm Implements Limited</td>
<td>Ubungo Industrial Area, Dar Es Salaam, Tanzania</td>
<td>Tel: 255 51 43075/43259/Fax: 255 51 43259</td>
</tr>
<tr>
<td>RUTEC (PTY) LTD.</td>
<td>50 Davies Street, P.O. Box 32011, 2017 Braamfontein Johannesburg, South Africa</td>
<td>Tel: 27 11 402 3245, Fax: 27 11 402 3246</td>
</tr>
</tbody>
</table>
### Mills/grinders

**Sismar**
BP 3214
20 rue Dr. Theze, Dakar
Senegal

**Jyoti Limited**
Bombay Shopping Centre
RC Duff Road
Vadodar 390 005
India

**Kirloskar Brothers Limited**
Udyog Bhavan, Tilak Road
Pune 411002
India

**Hindsons Pvt Limited**
The Lower Mall
Patiala, 147001,
Punjab
India

**CECOCO**
P 0 Box 8
Ibaraki City
Osaka 567
Japan

**PACESL - Professional Agricultural Consultancy and Expertise Services of Liberia**
Vai Ioron, Bushwel Island,
P.O. Box 148, 1000 Monrovia
Liberia

**Ste Les Fils De Louis Samat**
10 Boulevard De Freres-Godchot 13392
Marseille Cedex 4, France

**Dandekar Brothers Engineers & Founders**
Sangli-Shivaji Nagar
416 416 Maharashtra
India

**Rajan Universal Exports**
Post Bag 250
Madras 600001
India

**Alvan Blanch Limited**
Chelworth
Malmesbury, Wiltshire
SN16 9SG, UK

### Presses and Expellers

**Lutanda Limited**
P O Box 20516
Kitwe
Zambia

**Agrico Agricultural Engineers Limited**
Kaneshe Industrial Area,
P.O.Box 1217 Accra-North
Ghana
Tel: 233 21 228 260/236 240/228 292
Fax: 233 21 230 481 /E-mail: agrico@ncs.com.gh

**Smallholder Agricultural Mechanisation Services - SAMS**
Woodlands, P/Bag W47 Lusaka
Zambia
Tel: +260 1 233 229 /Fax: 260 1 233 229

**Tanroy Engineering (Pvt.) Ltd.**
179 Loreley Crescent, off Mutare Road,
P.O. Box AY 382,
4 Amby, Msasa Harare
Zimbabwe
Tel: 263 4 487791/3 /Fax: 263 4 487794

**CGC Agricultural Service Ltd**
No.1 Clarkson Street, SK 2591
Banjul
Gambia
Tel: +220 222 254 /Fax: 220 222 254

**Fateco Ltd**
Agbogba Village, 3 km. off Madina-Kwabenya Road,
P.O. Box 9899 KIA Airport, Accra Ghana
Tel: 233 663114/303029/502547

**TAMSA Trading**
152 Sidwell Avenue,
P.O. Box 14305,
6061 Port Elisabeth
South Africa
Tel: 27 41 43 339 /Fax: 27 41 411 731

**SP Engineering Corporation**
PB No 218, 79/7 Latouche Road
Kanpur 208 001
India
Palm/palm kernel oil equipment

Agrico Agricultural Engineers Limited Kaneshie Industrial Area
P.O.Box 12127 Accra-North
Ghana
Tel: 233 21 228 260/236 240/228 292
Fax: 233 21 230 481
E-mail: agrico@ncs.com.gh

KADDAI Engineering Enterprise
No. O.I. 89 Ashantti New Town,
P.O. Box 2268, Kumasi
Ghana
Tel: +233 51 20 492
Fax: +233 51 27 628

Shea butter equipment

Agrico Agricultural Engineers Limited Kaneshie Industrial Area
P.O.Box 12127 Accra-North
Ghana
Tel: +233 21 228 260/236 240/228 292
Fax: +233 21 230 481
E-mail: agrico@ncs.com.gh

Gack Engineering
Tantra Hills, New Achimota,
Ant / B / 016 Accra,
P.O. Box 15883 Accra
Ghana
Tel: +221 21 404109/403744/403801

Useful contacts and further information
Further information can be obtained from the following organisations:

- Enterprise Works Worldwide, 1828 L Street NW, Suite 1000, Washington, D.C. 20036 USA. Tel: 202 293-4600, Fax: 202 293-
Formally ATI (Appropriate Technology International) it has expertise and information on small-scale oil extraction in Africa, particularly using manual Bielenberg Ram Presses.

- ATU, Appropriate Technology Unit, Dept. of Community Development, Ministry of Local Government and Lands, 13 Marina Parade Banjul, GAMBIA, Tel: 220 228 178, Fax: 220 228 178. Has expertise in shea butter and coconut oil extraction and supplies equipment for both products.

- CFTS Centre de Formation Technique Mgr. Steinmetz, Quartier Gbena, Route de Lome, sur la droite venant de Cotonou, B.P. Quidah, Atlantique Quidah, BENIN, Tel: 229 34 13 35. Has expertise in palm/palm kernel oil and supplies presses/expellers, palm/palm kernel equipment.

- COMFAR Cooperative des Ouvriers Metallurgiques de Faranah, Quartier Aviation en face de l'Aeroport de Faranah, B.P. 11 Faranah / B.P. 2399 Conary Faranah, GUINEA, Tel: 224 41 20 88 / 41 20 98, Fax: 224 41 20 88. Has expertise in palm/palm kernel oil extraction and supplies equipment.

- CPTI Centre Pilote de Technologie Industrielle, s/c Ministère de la Promotion du Secteur Prive, de l'Industrie et du Commerce, B.P. 468 Conary, GUINEA, Tel: 224 46 26 95. Has expertise in shea butter and palm/palm kernel oil extraction and supplies equipment for both products.

- Department of Agricultural Engineering, Egerton University, PO Box 536, Njoro, KENYA, Tel: 254-37-61620, Fax: 254-37-61442. Has expertise on oil extraction.

- D.T.E - C.I. Materiel Agro-Industriel, 37, Rue de l'Industrie, Boulevard de Marseille, Zone 3, B.P. 18-629 Abidjan, CÔTE D'IVOIRE, Tel: 225 242666, Fax: 225 242688. Has expertise in shea butter extraction and supplies presses/expellers and shea butter equipment.

- FAKT (Association for Appropriate Technologies in the Third World), Gaensheidstrasse 43, 7000 Stuttgart 1, GERMANY. Tel: 00 49 711 210950, 2109526, Fax: 0049-711-2109555, E-mail: Fakt_ger@comuserve.com. Has expertise in oil extraction from a wide variety of materials, information and assistance in project development.

- FAO, Viale delle Terme di Caracalla, Rome 00100, ITALY. Has information on equipment and suppliers, publications and research/project reports of oilseed processing in developing countries (see website below).

- GRATIS (Ghana Appropriate Technology Industrial Services), PO BOX 151, Tema, PO BOX M 39., Accra GHANA, Tel: 0221 4243 or 00 221 42430, Fax: 00 221 6251/233 21 77488.Has expertise and information on palm oil, coconut oil and shea butter processing and supplies equipment.

- IDRC 250 Albert St., Ottawa, K1G 3H9, Canada, www.idrc.ca. Has information and project activities in all types of oil processing.

- IITA, International Institute for Tropical Agriculture, Post-Harvest Engineering Unit, Resource and Crop Management Division, PMB 5320, Oyo Road, Ibadan, NIGERIA, Tel: 234 2 241 2626, 234 22 400300/319Fax: 234 2 241 222, 234 22 874 1772276, Email: iita@cgnet.com. Has information and expertise in all types of oil extraction, information on equipment suppliers and reports on oil extraction projects.

- Practical Action Southern Africa, 3rd Floor, Coal House, 17 Nelson Mandela Ave, Harare, Tel: 00 263 4 750880 Fax: 00 263 4 771030. Has information and expertise in establishing small-scale sunflower and groundnut oil extraction enterprises.

- Nova-SOTECMA, Sari Av. 1o Congresso do MPLA 24-26, C.P. 306 (Caixa postal), Luanda, ANGOLA, Tel: 244 2 330 343/5, Fax: 244 2 335 378. Has expertise in palm/palm kernel oil extraction

- Oilsseeds Development 13 Upper High St., Thame, Oxon, OX9 3HL, UK. Tel: 44 (0) 1844 214153

- SAMeP Smallholder Agricultural Mechanization Promotions (umbrella organization: AFRICARE) 87 Provident Street, P.O. Box 36658 Lusaka, ZAMBIA, Tel: 260 1 239 794/233 578, Fax: 260 1 235 665/226 406, Email: samep@zamnet.zm. Has expertise in shea butter extraction
• Technical Assistance (Int), P O Box 1224, Vosskuhlenweg 2, Bargteheide, GERMANY. Has information on oil extraction.
• TEMDO Tanzania Engineering & Manufacturing Design Organisation P.O. Box 6111 Arusha
  Tanzania, Tel: 255 57 8058/6220, Fax: 255 57 8318, E-mail: temdo@habari.co.tz. Has information on oil extraction and supplies presses/expellers.
• Unata, GVD Heuvelstraat 131, 3140 Ramsel, BELGIUM, Tel: 00 32 16 56 1022. Has expertise in small scale oil extraction, information on processing and supplies presses, seed scorchers and other equipment.

The following publications describe oil extraction in more detail:

For producers who can obtain assistance from a small business advisory service or an international development agency that has access to the Internet, there are 100+ websites on soap making. Most are either commercial sites that sell essences, oils etc that can be added to soap, or home soapmakers sites that give recipes and information on how to make soaps. The following websites have useful information and good links to other sites:

www.fao.org/inpho has details of oil processing equipment and manufacturers around the world.

www.fao.org.agris has news of science research in developing countries, and access to science journals and FAO databases via its documentation centre. Also an Agric/Caris magazine.

www.iita.org has publications and contacts for research and development of oilseeds in developing countries

www.oilseed.org website of the National Institute of Oilseed Products, has an international membership of companies, including processors, equipment suppliers, importers and exporters.

www.idrc.ca has publications and contacts for research and development
of oilseeds in developing countries

www.undp.org/fi has details of coconut oil production as part of a Small Enterprise Development programme.